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ends, sufficient to admit a short tube or ferrule of the same inside diameter as the hole. As each block is lowered into the trench, and placed in position, a large plate of iron, previously heated, is held between one end of it and the end of the block it is to join. The heat softens the pitch, and removes any oil which may have been left by the mould. The iron is then removed, the block drawn back a few inches, and the ferrules are put in place. These ferrules are of such length, that, when pushed firmly into place against the shoulders of the enlargement, the blocks remain about an inch apart. The block, with ferrules inserted, being in position, a round wooden bar, split lengthwise into two long wedges, is inserted into each hole or duct, running back through the ferrules into the other block. One part of each bar is then slid upon the other, until they fill the hole snugly, the result being that the blocks are brought into practically exact alignment. Next, iron plates, embracing the joined ends of the blocks, are clamped in position, and the space between the blocks and surrounding the ferrules is filled with hot pitch concrete solidly rammed. Then the aligning bars are removed, and the operation is repeated with each subsequent block. The space between the conduits is filled with hydraulic cement, and the double conduit enclosed in brick-work, the completed subway presenting the appearance shown in section in the accompanying diagram.

#### THE STANDARD TYPOGRAPH.

THERE is now being perfected in this city a machine intended to dispense with type and typesetters in certain kinds of printing. The 'standard typograph' is the name selected for it by its inventors, though the term 'matrix puncher' would be a more fitting title. A good idea of its general appearance may be gathered from the accompanying illustration. At first glance, it seems to be a combination of an enlarged type-writer and a sewing-machine, possessing the key-board of the former and the stand and operating mechanism of the latter. The typograph is in reality a kind of type-writer, but, instead of printing upon paper, it produces indented or depressed characters upon a sheet of soft metal, from which an electrotype may be made, as from the wax matrix taken from type, in the usual electrotyping process.

The principal parts of the machine are, the key-board, resembling that of the Remington type-writer; the type-wheel, which revolves in a horizontal plane; and the matrix carriage, immediately above the type-wheel. Part of the last is shown in the engraving, above the key-board,

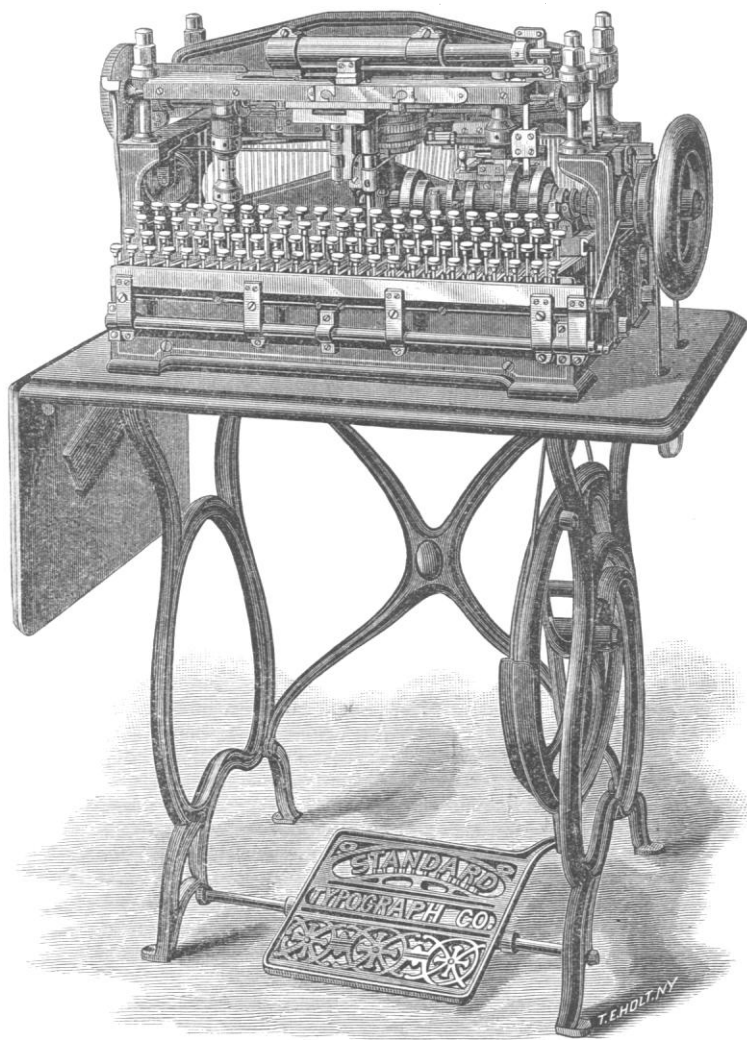
about the middle of the machine. Fitted in vertical grooves in the periphery of the type-wheel are a number of steel types, one for each character used in ordinary printing, the face of the type being upward, toward the matrix carriage. Two small lugs or stops project from the wheel at diametrically opposite points. Arranged in a semicircle at the rear of the wheel are two rows of detent levers, the outer end of each lever being connected by a link with a finger-bar of the keyboard, much as the type-bar of a type-writer is connected with its key. The detent levers are pivoted near the inner end, so that the depression of a finger-bar, or key, as it may be called, raises the inner end of its connected lever into the plane of revolution of one of the stops of the type-wheel, each stop being located on the wheel slightly above its corresponding semicircle of levers.

The matrix carriage, one end of which is shown in the engraving, above and to the left of the type-wheel, has movement in two directions in a horizontal plane. The side movement, from left to right or *vice versa*, is communicated to the carriage by the return of a key to its normal position after being depressed to form a character in the matrix. This side movement, or letter-spacing, is variable, and is governed by the key depressed, so that the carriage is moved each time a space equal to the exact width of face of the type impressed in the matrix. Thus, for the letter *h* or *g*, the carriage would move twice as far as for *i* or *l*. By a simple adjusting device, this movement may be changed so as to leave a space between the letters, as shown in the concluding line of the sample paragraph given farther along. The other movement of the carriage, that required to bring the matrix into position for a new line, is produced by depressing a key provided for that purpose. This movement also may be varied so as to leave greater or less space between the lines.

The manner of operating the machine is as follows: the matrix, which, as at present used, is a sheet of lead about one thirty-second of an inch thick, is secured firmly to the carriage, and adjusted, face downward, in its place above the type-wheel. The operator, having his 'copy' within easy reading distance, puts the type-wheel in motion by means of the treadle, and depresses the keys one after another, according to the word or space desired, as in the ordinary type-writing machine. As each key is struck, the end of its detent lever, by contact with the projection on the wheel, stops the revolution of the latter, holding it in such a position that the type desired is in place for striking the matrix at the proper point. At the same instant the type is forced upward by a revolving cam, producing an impression of its face

in the matrix. The cam continues to revolve, the type drops back into place, the wheel is released and continues its rapid motion, and the carriage moves into position for the next letter, the whole operation being practically instantaneous, and the rapidity of working being limited only by the skill

and the last letter is struck. The 'feed' of the carriage is then reversed, and the rest of the line filled in backward. This is done so that the ends of the lines may be even, as the spacing between the words is not automatic, but depends altogether upon the skill and accuracy of eye of the



THE STANDARD TYPOGRAPH.

of the operator and the speed of the treadle. The next letter is produced in the same way ; and so on to the end of a word. Then the carriage is moved ahead sufficiently for the space desired by touching an appropriate space-key. This is continued until within two or three words of the end of the line, when the carriage is run on to the end,

operator. One line finished, the carriage is returned to the starting-point, the line-spacing key is struck, bringing the matrix into position for the next line, and the various operations are repeated. When the matrix is completed, it is removed from the carriage, and an electrotype taken ; and this electrotype is supposed to take the place of

type on the printing-press. The following short paragraph is printed from an electrotpe made direct from a leaden matrix produced upon the typograph:—

Although more than four hundred years have elapsed since the art was invented, it is a singular fact that the bulk of the world's printing to-day is done with movable types "set up" on the same plan adopted originally.

To the eye of the practical printer there are several defects in the above sample paragraph. The first word is not set in far enough from the end of the line. That is the fault of the operator, for which the machine cannot be held responsible. Some of the letters are too close together, and others too far apart; the letters do not range well, giving an irregular or 'squabbled' appearance to the line; some of the letters, notably the *e*, do not correspond in size with the others; and some, again, appear to be higher than the rest, giving a blacker impression. All these defects are doubtless due to imperfect workmanship on the part of machinists and type-cutters, and may easily be overcome in a more perfect machine. Another defect noticeable in the work of this machine is uneven spacing between the words. In the machine as at present constructed, this defect cannot be remedied except by almost superhuman skill on the part of the operator; but the inventors claim that in future machines, and with type cut on a 'unit' system (the width of face of each type being a known multiple of some unit taken as a standard), justification will be as easily accomplished as in ordinary type-setting. This remains to be seen. Still another defect, and a very grave one, is the difficulty of correcting errors. A wrong letter in a word, or a wrong word in a sentence, if about the same size as the right one, may be corrected by smoothing down the metal and repunching over the smoothed surface. But the omission of one or more words, or their repetition, can be remedied only by a new matrix, whole or in part. Neither can changes be made in the wording of a sentence, something frequently desired by writers upon inspection of their proofs. With 'copy' prepared exactly as it should be printed, and an operator proof against error, this defect would not be conspicuous; but perfection is no more prevalent among writers and operators than among inventors and machinists.

But were the machine perfect in all other respects, there is still one defect which practical printers who have examined the typograph and its work consider fatal, and one which, in the opinion of experts, will be found extremely difficult if not impossible to overcome. When the

steel type is forced into the soft metal of the matrix, it leaves a perfect impression; but, when the next type is forced in, the metal is pushed aside to a greater or less extent, thereby disturbing the previous impression, and preventing the full face of all the type from 'showing up' in print. This defect will be readily seen by comparing the sample paragraph with the contiguous paragraphs, which are printed from ordinary type. In the last three words of the sample paragraph, the metal has not been so much disturbed, as the letters are purposely set some distance apart, that there may be a protecting wall of metal left between them. Of course, it may be possible to discover some material for the matrix that will give better results in this respect, or some way may be devised to punch the metal without forcing it aside. These problems remain unsolved. In its present stage, the typograph shows an important advance in the direction of cheaper and more rapid book and newspaper work; but much yet remains to be done before the machine can be placed upon the market as a commercial and typographical success.

#### NOTES AND NEWS.

FROM a correspondent in Tokio we learn that on his return from America he presented a report on the resolutions of the Washington meridian and time congress. A committee was appointed by the proper authorities to discuss the matter, and on the 12th of July an imperial decree to the following purpose was issued: first, the meridian passing through Greenwich shall be the initial meridian for longitude; second, longitude shall be counted from this meridian in two directions up to 180°; third, the time of the meridian of 135° east shall be used as the standard time throughout Japan.

—A fireman on the steamer *Alvo*, which lately arrived in New York from Central America, was taken sick, and entered St. Vincent's hospital for treatment. The fever from which he suffered simulated yellow-fever to such a degree as to make his removal to the Reception hospital of the health department advisable. The attack proved fatal, and an autopsy revealed a yellow liver, a stomach filled with blood, and the other organs jaundiced. It was the unanimous opinion of the physicians present that yellow-fever was the cause of death. It is as yet unexplained how and where the disease was contracted, as it is reported that the health officer of the port never knew of yellow-fever existing at any port at which the *Alvo* had been.

—The report of F. H. Wines, special agent of the tenth census, on the defective, dependent, and